

**PROCESS FOR MANUFACTURING A MOLDED  
PLASTIC WINDOW FOR AN AUTOMOTIVE VEHICLE AND  
WINDOW PRODUCED THEREBY**

**Cross Reference to Related Applications**

This application claims the benefit of the filing date of provisional application 60/140,422, filed on June 22, 1999.

**Background of the Invention**

This invention concerns glazing particularly for automotive window panels. It has long been proposed to construct windows for automotive vehicles from synthetic resins, i.e., from plastic material. A suitable such material is polycarbonate, and use of this material of automotive windows has long been proposed. By hardcoating the surfaces by processes heretofore developed, sufficient scratch resistance can be achieved to produce automotive window panels performing well in service. Other coatings are also now available, such as UV blocking coatings to further improve the performance of plastic windows for automotive vehicles.

Molded plastic automotive windows offer a number of advantages over conventional glass glazing, including a significant reduction in vehicle weight and improved vehicle safety, as the polycarbonate panels better resist shattering as compared to glass, and in a crash fixed plastic windows keep the occupants from being ejected from the vehicle passenger compartment better than existing glass windows. Greater design freedom is afforded by plastic windows due to the ease in forming complex curved shapes.

One problem with polycarbonate panels used for automotive windows is a lack of edge stiffness, important for moving or "drop" windows. The edges of such plastic panels are

insufficiently stiff to reliably maintain registry with the window guides and seals, and can be pushed out by impact of an occupant with the window in a crash.

A requirement for existing fixed windows is a masking border to conceal the body and seal structure at the jointer of the window periphery to the body, which masking border requirement adds processing steps in manufacturing such window panels.

U.S. patents nos. 5,339,584 and 5,035,096 both propose certain techniques in manufacturing synthetic resin windows for automotive vehicles in order to overcome the lack of stiffness in a molded plastic window panel.

U.S. patent 5,339,584 describes an insert molding technique for attaching a reinforced frame to an optical main glazing panel.

U.S. patent 5,035,096 describes producing a hollow frame portion extending about the perimeter of the main panel, the frame hollow portion formed by a gas assist technique, in which gas is injected into a cavity defining the frame portion, the gas expanding within the plastic to create the hollow shape of the frame portion.

In this approach, the hollow frame is molded as one piece with the optical panel and is thus formed from the same resin material, to be integrally molded therewith. In order to provide the masking border treatment, an extra painting or coating process is required. The hollow frame is an efficient way of achieving adequate perimeter stiffness, but there are several problems with the approach described in that patent.

Firstly, optical flaws are sometimes produced by the assist gas migrating into the main mold cavity where the main panel is formed. Also, stress riser cavities could be formed by such migrating gas. Other slight optical flaws can occur because of the two cavities inducing residual stresses in the optical portion.

1           The resin used in the optical panel does not itself form a particularly stiff material,  
2 and the use of the same material in the frame portion thus compromises the rigidity which could  
3 otherwise be achieved.

4           It is the object of the present invention to provide a manufacturing process for  
5 providing a hollow frame on the perimeter of a molded plastic main glazing panel which  
6 minimizes optical flaws in the main glazing panel.

7           It is a further object to provide such process in which the panel rigidity can be  
8 maximized by allowing the use of a different stiffer material in the frame portion.

9           Yet another object is to provide a process for manufacturing a glazing panel  
10 having a hollow perimeter frame which can eliminate other processing steps.

11           Still another object is to provide such process which allows many processing  
12 options to enhance manufacturing efficiency.

#### 13 14 Summary of the Invention

15           These and other objects which can be appreciated by a reading of the following  
16 specification and claims are achieved by utilizing a two shot process, in which the optical main  
17 glazing panel is separately molded from the hollow frame portion, the hollow frame portion  
18 formed by a conventional gas assist process.

19           The two shot molding process can be achieved by various options including  
20 overmolding (using movable cores, with either the frame or main molded panel first, using a  
21 second nozzle, for example), transfer molding, in which a separate mold is used for each part, or  
22 insert molding in which one or the other part is molded first, and inserted in a mold for the  
23 second part.



1 Separate molding of the main panel and the hollow frame portion eliminates many  
2 of the optical flaws resulting from gas migration, residual stresses and sink marks.

3 Separate molding also allows different draft angles for the hollow frame portion.

4 The frame portion may be molded from a stiffer material such as a filled resin to  
5 maximize the rigidity of the frame portion to maximize the rigidity of the window edge.

6 The frame portion material can also be rendered opaque to provide border  
7 masking without the need for a separate coating or painting step, or to necessitate the a difficult  
8 insert film molding step described in the above referenced patents.

9 Simplification of the complete window manufacturing process is also possible  
10 with the two shot molding approach, i.e., reinforcing ribs, latching and hinging features can be  
11 more easily molded into the frame portion to eliminate attachment of separate parts.

#### 12 13 Description of the Drawing Figures

14 Figure 1 is a fragmentary perspective view of a molded plastic window panel  
15 made by a process according to the present invention.

16 Figure 2 is a transverse sectional view of the window panel shown in Figure 1.

17 Figure 3 is a sectional view of a second embodiment of a window panel according  
18 to the invention.

19 Figure 4 is a fragmentary perspective view of a third embodiment of a window  
20 panel according to the present invention.

## Detailed Description

In the following detailed description, certain specific terminology will be employed for the sake of clarity and a particular embodiment described in accordance with the requirements of 35 USC 112, but it is to be understood that the same is not intended to be limiting and should not be so construed inasmuch as the invention is capable of taking many forms and variations within the scope of the appended claims.

Referring to the drawings, and particularly Figures 1 and 2, a portion of a molded plastic automotive window 10 is shown, which includes a main glazing panel 12 optically undistorted, and a hollow frame portion 14 extending about the perimeter of the main panel 12. The main glazing panel 12 is injection molded from a suitable synthetic resin such as polycarbonate as a first shot, producing a generally planar panel, although typically having some degree of curvature as desired for a particular application.

The hollow frame portion 14 is injection molded in a second shot, using gas assist techniques to produce a cavity 16 creating the hollow cross section of the frame portion 14.

The hollow frame portion 14 has a wall 18 having one side contiguous to and overlying the inside surface 20 of the main panel 12. The material used to mold the frame portion 14 is preferably of a stiffer modulus such as a filled polycarbonate or another resin which is compatible so as to form a melt bond between the contiguous surfaces. The resin material can be blackened as by the addition of lamp black, or rendered opaque in some other way such that the frame portion 14 itself provides the masking border treatment for the perimeter of the window 10..

The two shot molding steps can be carried out in various alternative ways, i.e., using a common mold with movable inserts or separate molds using the first molded part as an



1 insert. Gas assist injection mold components must also be incorporated in the mold. Since these  
2 techniques and mold design features are well known in the field, such mold details are not here  
3 described in detail.

4 Main panels 12 produced by the method of the present invention are usually free  
5 of the optical flaws described above, while providing a substantially enhanced edge stiffness of  
6 the complete window 10.

7 Figure 3 shows another form of connection between a main panel 12A and a  
8 hollow frame portion 14A, in which an inwardly projecting rib 22 has an angled edge 24 which  
9 abuts a perimeter edge 26 of the main panel 12A, bonded along the interface so formed.

10 The hollow frame portion 14A also has an integral outwardly projecting rib 28  
11 offset out of the plane of the main panel 12A. The rib 28 can be used to retain the window 10A  
12 in a body structure mounted window guides (not shown), securing the window in position  
13 against a weather seal (not shown) and preventing the window 10A from being too easily pushed  
14 out of the window opening.

15 The offset "d" is advantageous in that the outer surface of the main panel 12A can  
16 now lie in approximately the same plane as the body sheet metal for improved styling.

17 Figure 4 illustrates a window 10B in which the frame portion 14B has integral  
18 attachment features 30 molded with the frame portion 14B.

19 Other features such as hinges, bosses, locators can easily be integrally molded at  
20 the same time since the frame portion 14B is molded separately from the main panel 12B.